IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

Larry C. Olsen et al.

Application No. 10/726,744

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For: THERMOELECTRIC DEVICES AND APPLICATIONS FOR THE SAME

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APPEAL BRIEF

This is an Appeal Brief filed under 37 C.F.R. § 41.37. A Notice of Appeal was received by the U.S. Patent and Trademark Office (USPTO) on February 7, 2011, making the Appeal Brief due on or before April 7, 2011. In accordance with 37 C.F.R. § 41.20(b)(2), this Appeal Brief is being filed together with the required fee of $270. If additional fees are required in connection with filing this Appeal Brief, please charge Deposit Account 02-4550.

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27 documents listed in the Evidence Appendix and the Authorities Cited Appendix are submitted herewith.

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I. REAL PARTY IN INTEREST

The real party in interest is Battelle Memorial Institute, the assignee of record of the present application (Reel 14762, Frames 583-588, recorded on December 2, 2003).

II. RELATED APPEALS AND INTERFERENCES

There are no related proceedings.

III. STATUS OF CLAIMS

Claims 1, 3, 5-18 and 37-39 have been rejected and are appealed. Claims 2 and 23-25 have been withdrawn from consideration. Claims 4, 19-22 and 26-36 have been canceled.

IV. STATUS OF AMENDMENTS

A Response to the Final Office Action, dated October 1, 2010, was filed February 7, 2011 and was entered.

V. SUMMARY OF CLAIMED SUBJECT MATTER

Based upon the Seebeck effect, thermoelectric (TE) power sources convert temperature differences across dissimilar materials into an electrical potential, or voltage. (P. 4, lines 13-14.) Appellant's TE power sources comprise, in part, arrays of thermocouples (115) having multiple n-type (110) and a p-type (120) thermoelements. (P. 7, lines 3-7.) The n-type and p-type thermoelements are formed of thin films of non-stoichiometric Bi_xTe_y, Sb_xTe_y and Bi_xSe_y compounds where x is about 2 and y is about 3, these materials being cosputter deposited under carefully developed parameters (p. 12, line 20 - p. 13, line 5; Fig. 11) to provide non-stoichiometric thin film compounds with particularly useful thermoelectric properties. (P. 12, line 27 - p. 13, line 5).

The thermoelements are deposited on a single flexible substrate (140) that is typically coil or in an accordion configuration so as to occupy a very small space. (P. 8, line 27 - p. 9, line 10; Figs. 2a, 3, and 5-8; p. 4, lines 6-9.) In certain embodiments, thin films of electrically conductive material (105) connecting the thermoelements of the thermocouple are sputter deposited as well. (P.7, lines 13-29.)

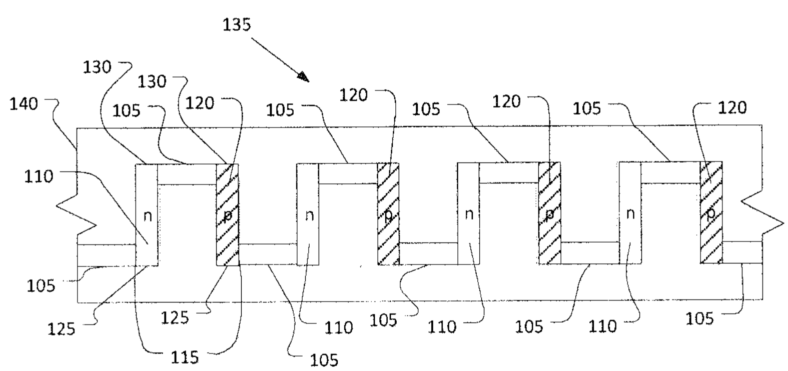

FIG. 2a

Certain embodiments of the TE power sources (100) comprise multiple TE thermocouples on the flexible substrate connected thermally conductive plates (150, 160). (P. 8, lines 12-16.) Electrical leads (180) may be connected to the array (135) of thermocouples of the TE power source 100 to receive and transmit the electrical energy produced through this thermal energy conversion by the device. (P. 8, lines 16-18).

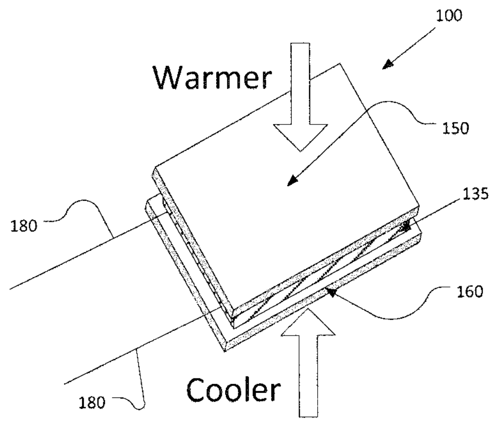

FIG. 4

For ease of reference, Appellant lists each independent claim under consideration, and the two dependent claims standing separately, with specification citations for each element therein.

Claim 1:

A thermoelectric power source comprising:

a flexible substrate having an upper surface (p. 11, lines 20-23); and

a plurality of thermoelectric couples with the thermoelectric couples (p. 7, lines 3-5; Fig. 2a, ref. no. 115; p. 4, lines 10-11) comprising:

(a) a co-sputter deposited thin film p-type thermoelement positioned on the upper surface of the flexible substrate (p. 4, lines 10-11; p. 7, lines 6-7; Fig. 2a, ref. no. 120; p. 6, lines 20-23);

(b) a co-sputter deposited thin film n-type thermoelement positioned on the upper surface of the flexible substrate adjacent the p-type thermoelement (p. 4, lines 10-11; p. 7, lines 6-7; Fig. 2a, ref. no. 120; p. 6, lines 20-23);

(c) an electrically conductive member (p. 7, lines 13-19; Fig. 2a, ref. no. 105) positioned on the flexible substrate, and electrically connecting the first end of the p-type thermoelement with the second end of the n-type thermoelement, wherein the p-type or the n-type thermoelements comprise Bi_xTe_y, Sb_xTe_y, or Bi_xSe_y wherein x and y form a non-stoichiometric compound and wherein x is about 2 and y is about 3 (p. 4, lines 12-13; p. 12, line 20 - p. 13, line 5; Fig. 11); and

wherein the thermoelectric couples are formed on a single substrate and the flexible substrate is in a coil configuration or an accordion configuration (p. 8, line 27 - p. 9, line 10; Figs. 2a, 3 and 5-8; p. 4, lines 6-9).

Claim 3:

The thermoelectric power source of claim 1 wherein the p-type and the n-type thermoelements comprise Bi_xTe_y, Sb_xTe_y, and Bi_xSe_y, wherein x is about 2 and y is about 3 (p. 10, lines 6-8 and original claim 30).

Claim 5:

The thermoelectric power source of claim 1 wherein the thermoelectric power source has a power output of from 50 μW to 1 W (p. 4, lines 7-10 and p. 8, lines 3-11).

Claim 37:

A thermoelectric power source comprising:

a flexible substrate having an upper surface (p. 11, lines 20-23); and

a thermoelectric couple (p. 7, lines 3-5; Fig. 2a, ref. no. 115; p. 4, lines 10-11) comprising:

(a) alternating thin film p-type and n-type thermoelements positioned on the upper surface of the flexible substrate (p. 4, lines 6-7; Fig. 2a, ref. nos. 110 and 120; p. 6, lines 20-23);

(b) an electrically conductive member positioned on the flexible substrate, and electrically connecting a first end of the p-type thermoelement with a second end of the n-type thermoelement (p. 7, lines 13-19; Fig. 2a, ref. no. 105), wherein the p-type or the n-type thermoelements comprise Sb_xTe_y or Bi_xSe_y wherein x is about 2 and y is about 3 (p. 4, lines 12-13; p. 12, line 20 - p. 13, line 5; Fig. 11); and

(c) wherein the flexible substrate is in a coil configuration (p. 8, lines 27-30).

VI. GROUNDS OF REJECTION FOR REVIEW

1. Claims 1, 3, 5-10, 12-15, 17, 18 and 37-39 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Migowski (PCT Publication No. WO 89/07836) in view of Böttner (Proc. 21st Int. Conf. Thermoelectronics).
2. Claims 11 and 16 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Migowski and Böttner as applied to claims 1, 3, 5-10, 12-15, 17, 18 and 37-39 above, and further in view of Bass (U.S. Patent No. 6,207,887).

Appellant traverses these rejections.

VII. ARGUMENT

Summary: It is Appellant's position that no *prima facie* case of obviousness has been presented against independent claims 1 or 37 as the combination of art suggested by the Examiner fails to meet all claim limitations. Even with the proposed combination of prior art, a person of ordinary skill in the art could not have made the claimed power sources because the references (even combined) do not disclose how to make the claimed thermoelements.

The Examiner admits that the primary reference, Migowski, does not teach or suggest Appellant's recited non-stoichiometric, co-sputter deposited thin film compounds that form the thermoelements.

(Office Action, 12/6/10, p. 4, lines 12-14.) The Examiner cites Böttner to make up for this deficiency of Migowski, but Böttner likewise fails to teach or suggest the recited non-stoichiometric, co-sputter deposited thin film compounds.

There is a disagreement between Appellant and the Examiner as to whether Böttner is enabling for the compounds the reference names and thus whether it makes up for the deficiencies of Migowski. The Examiner rejects Appellant's arguments as to the non-enablement of the Böttner reference and appears to give no weight to the § 1.132 Declaration of Paul. H. McClelland. Specifically, the Examiner disagrees with Appellant's and Mr. McClelland's position that Böttner is not an enabling disclosure due to the lack of disclosing how to make the claimed compounds and disagrees as to whether there would be undue experimentation required in attempt to make the claimed thin film thermoelement compounds of Appellant's power source.

Issues:

Appellant and the Examiner are in agreement that the primary reference does not teach or suggest the claimed cosputter deposited p-type or n-type thermoelements comprising non-stoichiometric Bi_xTe_y, Sb_xTe_y, or Bi_xSe_y, wherein x is about 2 and y is about 3. (Office Action, 12/6/10, p. 4, lines 12-14.)

The Examiner asserts that Böttner enables one of ordinary skill in the art to make p-type and n-type thin film thermoelements, all on a single substrate, by cosputter deposition to form the compounds Bi_xTe_y, Sb_xTe_y, or Bi_xSe_y, wherein x and y form a non-stoichiometric compound. (Claims 1 and 37.) The Examiner also asserts that Böttner enables one of ordinary skill in the art to make tertiary p-type and n-type thermoelements, all on a single substrate, comprising all of Bi_xTe_y, Sb_xTe_y, and Bi_xSe_y, wherein x is about 2 and y is about 3. (Claims 3 and 17.) Additionally, the Examiner asserts that Böttner teaches how to make thermoelement thin films comprising Bi_xTe_y and Sb_xTe_y, or Bi_xTe_y and Bi_xSe_y. (Claims 12, 17 and 18.) Appellant disagrees.

Essentially, the Examiner gives little or no weight to the McClelland § 1.132 Declaration that outlines the missing, necessary guidance in Böttner to make the named compounds. The Examiner also indicates that even though Böttner may provide no guidance, and although it may require complex and *per se* extensive experimentation in attempt to make Böttner's named compounds, the complexity and extensive quantity of experimentation is not "undue." (Office Action, p. 7.) Appellant (as well as the Declaration of one of ordinary skill in the art) has shown that Böttner is not enabling for the claimed devices and any experimentation as suggested by the Examiner would have been undue and unpredictable.

(Appellant notes that Böttner does not teach or suggest the claimed power sources (nor does the Examiner assert it for such) but is cited by the Examiner only as a reference that allegedly teaches how to make the claimed thin film thermoelements of Appellant's power sources.)

A. The Law of Enablement in Regard to Prior Art References

In order to act as anticipating prior art, a reference (or combination of references) must enable one of ordinary skill in the art to make the invention without undue experimentation. *Impax Laboratories Inc. v. Aventis Pharmaceuticals Inc.*, 545 F.3d 1312 (Fed. Cir. 2008). In other words, the prior art must inform as to how to make the claimed invention. *Minn. Mining & Mfg. Co. v. Chemque, Inc.*, 303 F.3d 1294, 1301 (Fed. Cir. 2002).

The naming of a compound in a reference, without more, cannot constitute a description of the compound and the reference is not enabling prior art. One of ordinary skill in the art must be able to make or synthesize the compound for the reference to be considered enabling prior art for the teaching of the compound to be made. *In re Hoeksema*, 399 F.2d 269 (CCPA 1968). In *In re Kubin*, 561 F.3d 1351 (Fed. Cir. 2009) the court further confirmed the court's holding in *In re O'Farrell*, 853 F.2d 894 (Fed. Cir. 1988), as reinvigorated by the Supreme Court in *KSR* (*KSR Int'l Co. v. Teleflex, Inc.*, 127 S. Ct. 1727 (2007), that the cited references must contain "detailed enabling methodology for practicing the claimed invention, a suggestion to modify the prior art to practice the claimed invention, and evidence suggesting that it would be successful." (Emphasis added.)

B. Lack of Enablement of the Böttner Reference for that which it is Cited

In the McClelland § 1.132 Declaration, Mr. McClelland[1] provides explanation and documentary evidence drawn from his knowledge as one skill in the art and from the cited reference itself, of the lack of the Böttner disclosure to provide the necessary guidance on how to make the named compounds. Mr. McClelland also provides a description of what information must be known (as disclosed in Appellant's specification) in order to make such compounds. Mr. McClelland outlines the problems with the Böttner reference as follows:

> Böttner enables only elemental sputtering, not the necessary simultaneous or co-sputtering needed to produce the non-stoichiometric compounds.
>
> i. Böttner names certain compounds but gives no guidance, let alone sufficient detail, for McClelland, one of ordinary skill (if not an expert in the field), to make the compounds.
>
> ii. The first line in the section "Growth of Thermoelectric materials" (page 514),[2] makes a statement that "n-Bi_2Te_3 and p-$(Bi,Sb)_2Te_3$ materials were grown by co-sputtering from 6" elemental targets but Böttner makes only that statement and otherwise does not

[1] Although Mr. McClelland's standing as one of ordinary skill in the art (if not an expert) does not appear to be challenged by the Examiner, Appellant notes that in addition to having more than 44 years of experience in the process development of display and power delivery systems, Mr. McClelland is an inventor on over 50 patents and is the VP of Technology of Perpetua Power Source Technologies, the licensee of Appellant's patents and applications covering this invention and won The R&D 100 Award in 2009 for its product incorporating this invention (see www.perpetuapower.com). This is not an assertion of commercial success but simply to elucidate Mr. McClelland's standing as a skilled artisan or expert in the field.

[2] The portion of Böttner relied on by the Examiner as an enabling disclosure.

disclose how to make the materials. Böttner indicates that elemental targets of Bi, Sb and Te were used to deposit n-Bi_2Te_3 and p-$(Bi,Sb)_2Te_3$ materials and refers to annealing the materials to adjust properties but again provides no further detail and so, as a person of ordinary skill, if not an expert, in the field, Mr. McClelland states that Böttner does not provide sufficient information so that he can make the named compounds. Specifically, for example, there is no evidence provided in Böttner or any other reference of record providing any of the following information necessary to cosputter deposit the non-stoichiometric compounds:

- ✓ Power levels applied to targets,
- ✓ Magnitude of the atomic flux emitted from each target;
- ✓ Substrate temperatures required during deposition;
- ✓ Temperatures used to anneal the films to adjust properties as disclosed;
- ✓ Distance between the substrates and the target(s); or
- ✓ The approach used for growth of p-$(Bi,Sb)_2Te_3$ materials.

iii. Mr McClelland states that as one of ordinary skill (if not as an expert) he may guess that elemental targets of Bi and Sb might be used to grow the films with particular Bi/Sb ratios but that there is not sufficient detail in Böttner so that he could make the compositions without copious experimentation and that this would be merely a guess at just one of the multiple parameters details needed – all the other parameters needed to be varied and tested would add exponentially to the number of experiments needed.

iv. The Examiner's reference to Figure 11a of Böttner, describes values for Seebeck coefficients of particular p-type materials versus Te content. These films are referred to as (Bi,Sb,Te) materials but Böttner makes no mention and provides no guidance regarding how to make these materials.

v. Böttner mentions one might try selenium as a component, but does not disclose that films were ever made that incorporated selenium or how such films could even be made.

vi. Fig. 10a of Böttner describes Seebeck coefficient of films versus Te content in atomic percent, and data are presented for cold sputtered and hot sputtered Bi_2Te_3, and annealed materials but there is no indication in the reference that the information recited in Fig. 10a is for co-sputter films from simultaneously targeted bismuth and tellurium sources and there is no discussion in Böttner as to how to make the compounds that would have the values listed in Figure 10a.

vii. Mr. McClelland explains that without the information noted above, as one of ordinary skill in the art, he would not have been able to make the compounds named in Böttner.

C. The Law of Enablement and Undue Experimentation in Regard to Prior Art References

Appellant understands that a further test of enablement is not whether any experimentation is necessary, but whether, if experimentation is necessary, it is undue. There are, however, many factors the Examiner failed to consider when determining whether there is sufficient evidence to support a determination that Böttner satisfies the enablement requirement and whether the admittedly complex and necessary extensive experimentation is "undue."

In *In re Wands*, 858 F.2d 731 (Fed. Cir. 1988), the Court indicated that the factors to be considered when determining whether experimentation is undue include but are not limited to:

(i) The breadth of the claims;
(ii) The nature of the invention;
(iii) The state of the prior art;
(iv) The level of one of ordinary skill;
(v) The level of predictability in the art;
(vi) The amount of direction provided in the disclosure;
(vii) The existence of working examples in the disclosure; and
(viii) The quantity of experimentation needed to make the compositions based on direction provided in the disclosure.

It is improper for the Examiner to conclude that the Böttner reference is enabling for the cosputter deposited thin-film thermoelements formed of Bi_xTe_y, Sb_xTe_y, or Bi_xSe_y (claims 1 and 37) **or** for the making of thermoelement thin films comprising Bi_xTe_y, Sb_xTe_y, and Bi_xSe_y, (claims 3 and 17) **or** thermoelements comprising Bi_xTe_y and Sb_xTe_y, or Bi_xTe_y and Bi_xSe_y (all wherein *x* is about 2 and *y* is about 3) (claims 12, 17 and 18) based on an analysis of only one of the above factors, while ignoring the others. The Examiner's analysis must consider all of the evidence related to each of these factors, and any conclusion of non-enablement of Böttner must be based on the evidence as a whole.

D. Evidence that Böttner is Not Enabling and the Suggested Combination of Prior Art Would Require Undue Experimentation

Based on all of the *Wands* factors (as discussed below), as well as the § 1.132 Declaration of one of ordinary skill in the art, if not an expert, Paul McClelland, Böttner is not enabling and any experimentation in attempt to make the named compounds in Böttner, would be undue under the law.

(i) The breadth of the claims – the Böttner reference does not teach or suggest the overall claimed device nor does the Examiner assert that it does. It must, however, teach how to make p-type and n-type thermoelements, all on a single substrate, by cosputter deposition to form the compound Bi_xTe_y, Sb_xTe_y, or Bi_xSe_y, wherein x and y form a non-stoichiometric compound,

wherein *x* is about 2 and *y* is about 3 (per claims 1 and 37),[3] the aspects of Applicant's claimed device that the Examiner admits Migowski fails to teach or suggest. Böttner also must enable the making of multiple tertiary p-type and n-type thermoelements, all on a single substrate, comprising all of Bi_xTe_y, Sb_xTe_y, and Bi_xSe_y, wherein *x* is about 2 and *y* is about 3, by cosputter deposition (claims 3 and 17).

(ii) The nature of the invention – both Böttner and Appellant's invention concern semiconductor, thin-film thermoelement materials.

(iii) The state of the prior art – the prior art of record does not teach or suggest the claimed thermoelectric power sources and as made clear by the Examiner's citing of Böttner, there is no reference teaching or suggesting the thermoelectric devices having the claimed thermoelement thin-film compositions. To make up for the deficiency of the prior art, the Examiner cites Böttner. But Böttner merely names one of the claimed compounds and does not give any guidance on how to make it. The Examiner, apparently in recognition of the fact that Böttner fails to give any guidance on how to make any of the claimed compounds, then cites a text book on physical vapor deposition processing, which text book, Mattox, discusses numerous parameters that can be manipulated when performing physical vapor depositions. There is no mention in Mattox as to the compositions in question or how to make such compositions. A text book regarding physical vapor deposition and all the parameters affecting such is not only insufficient as evidence on the making of the claimed thermoelements, it is evidence that cosputtering is a complex process not lending itself to being obvious. No reference has been cited that teaches how to make the claimed thin-film thermoelements or even the composition from which they are formed.

(iv) The level of one of ordinary skill – the inventors of the present application as well as the § 1.132 Declarant McClelland are well educated.

(v) The level of predictability in the art – the level of predictability in the art is low, as the predictability of chemistry in general is low. In fact, the Böttner reference itself is about the difficulties in fabrication processes for suitable thermoelectric microdevices and focuses on wafer-based fabrication processes for making Peltier devices, noting the difficulties encountered in doing so. Böttner reports the lack of understanding of certain of the actual growths made, such as noting undesirable cracking in part of the material grown without knowing how it occurred (p. 515) and stating in the Conclusion that the disclosed fabrication methods were "under development" – not known or developed – and that "progress may be expected" (p. 517). This all indicates that the Böttner publication is evidence of the unpredictability of the art.

[3] And Böttner fails to provide any mention or guidance as how a person of ordinary skill in the art could make thermoelement thin films comprising Bi_xTe_y, Sb_xTe_y, and Bi_xSe_y, (claims 3 and 17) or thermoelements comprising Bi_xTe_y and Sb_xTe_y, or Bi_xTe_y and Bi_xSe_y (all wherein x is about 2 and y is about 3) (claims 12, 17 and 18). As to these thermolements claimed, the Examiner provides no evidence or prior art teaching at all.

(vi) The amount of direction provided by the disclosure – there is no direction provided in Böttner as how to cosputter deposit the claimed thin-film compounds or thermoelements. This issue is discussed above.

(vii) The existence of working examples – there are no examples in the Böttner reference showing or describing how to make the claimed compounds or thin-film thermoelements. Böttner discloses only elemental sputter deposition processing. This issue is discussed above.

(viii) The quantity of experimentation needed based on the content of the disclosure – as admitted by the Examiner, the cosputter deposition is a complex set of parameters, conditions and methodologies. (Office Action, 12/6/10, p. 7, line 20-23.) Varying all these different parameters, conditions and methodologies, to make the claimed compounds and thin-film thermoelements with the desired physical characteristics, considering it from the standpoint of simple mathematics, *per se* illustrates the extensive quantity of experimentation that was required for the inventors to develop the disclosed invention.

Weighing the eight factors above,[4] it is a fair conclusion that Böttner requires undue experimentation and, thus, is not enabling for that which it is cited.

Independent Claim 1 (with which claims 6-18 stand together)

Claim 1 recites, in part, a power source with the above discussed thermoelements, namely, cosputter deposited p-type and n-type thin films comprising Bi_xTe_y, Sb_xTe_y, or Bi_xSe_y wherein x and y form a non-stoichiometric compound with *x* about 2 and *y* about 3. Because Migowski fails to teach or suggest such thermoelements and Böttner fails to make up for the deficiencies of Migowski, claim 1 is allowable over the art of record and reversal of the Examiner's rejection is respectfully requested.

Dependent Claim 3

Dependent claim 3 recites:

> The thermoelectric power source of claim 1 wherein the p-type and the n-type thermoelements comprise Bi_xTe_y, Sb_xTe_y, **and** Bi_xSe_y, wherein *x* is about 2 and *y* is about 3.

The Examiner indicates that Applicant's arguments that Böttner does not disclose or even contemplate tertiary TE thin-film materials, which is also commented on in the McClelland § 1.132 Declaration, are essentially correct but states that Böttner mentions selenium and then concludes that

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[4] Summary of the factors:
- ✓ the prior art completely lacks any teaching of the making of the compounds and thin-film thermoelements;
- ✓ extensive amounts of experimentation would be necessary;
- ✓ Böttner has no examples;
- ✓ Böttner offers no direction or guidance on how to make the compounds;
- ✓ the art is not predictable, having a very complex nature.

Böttner therefore discloses tertiary compound thermoelements and that it would be obvious choice of multiple known thermoelectric materials anyway. (Office Action 12/6/10, p. 8, lines 5-16.)

As discussed above, one of ordinary skill in the art could not make the claimed Bi_xTe_y, Sb_xTe_y, **and** Bi_xSe_y, wherein x is about 2 and y is about 3, thermoelements by reviewing Böttner's brief mention of the potential use of selenium as a component. Böttner never discloses that any tertiary thin film thermoelements were made or how to make such films. The Examiner fails to provide a reference that teaches or suggests this claim limitation. Accordingly, Appellant respectfully requests that the rejection of claim 3 be reversed.

Dependent Claim 5

Dependent claim 5 recites:

> The thermoelectric power source of claim 1 wherein the thermoelectric power source has a power output of from 50 μW to 1 W.

The Migowski disclosure does not teach or suggest a TE power source capable of producing from 50 microwatts to 1 W of electrical power and Böttner fails to make up for this deficiency of Migowski.

As the Examiner acknowledged (Office Action dated 9/1/2010, p. 4), the Migowski reference indicates that its device produces a power of only 11 microwatts. (Migowski English translation p. 4, second full paragraph beginning with "Layer thickness ...".) There is no indication in Migowski of a power source having a power output in the range claimed and the Examiner's statement that it is merely a matter of application of the device and that "choice of element length, width, and thickness is known in the art to affect the power output available from a thin film thermocouple device ... " with nothing more, no cited reference or other support for the conclusory statement, is not sufficient to support a *prima facie* case of obviousness.

Because the Migowski disclosure fails to teach or suggest a TE power source capable of producing from 50 microwatts to 1 watt of electrical power and Böttner fails to make up for the deficiency of Migowski, no *prima facie* case is presented and Appellant respectfully requests that the rejection of claim 5 be reversed.

Independent Claim 37 (with which claims 38-39 stand or fall)

Claim 37 recites:

A thermoelectric power source comprising:

a flexible substrate having an upper surface; and

a thermoelectric couple comprising:

(a) alternating thin film p-type and n-type thermoelements positioned on the upper surface of the flexible substrate;

(b) an electrically conductive member positioned on the flexible substrate, and electrically connecting a first end of the p-type thermoelement with-a second end of the n-type thermoelement, wherein the p-type or the n-type thermoelements comprise Sb_xTe_y or Bi_xSe_y wherein x is about 2 and y is about 3; and

(c) wherein the flexible substrate is in a coil configuration.

Claim 37 thus, like claim 1, includes the limitation of p-type or the n-type thermoelements comprising Sb_xTe_y or Bi_xSe_y wherein x is about 2 and y is about 3. As discussed above, nothing in Migowski or Böttner teach or suggest with sufficient enablement, Sb_xTe_y or Bi_xSe_y thermoelement materials. Accordingly, Appellant respectfully requests the rejection of claim 37 be reversed.

Respectfully submitted,

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Claims Appendix

1. (Rejected) A thermoelectric power source comprising:

a flexible substrate having an upper surface; and

a plurality of thermoelectric couples with the thermoelectric couples comprising:

(a) a co-sputter deposited thin film p-type thermoelement positioned on the upper surface of the flexible substrate;

(b) a co-sputter deposited thin film n-type thermoelement positioned on the upper surface of the flexible substrate adjacent the p-type thermoelement;

(c) an electrically conductive member positioned on the flexible substrate, and electrically connecting the first end of the p-type thermoelement with the second end of the n-type thermoelement, wherein the p-type or the n-type thermoelements comprise Bi_xTe_y, Sb_xTe_y, or Bi_xSe_y wherein x and y form a non-stoichiometric compound and wherein x is about 2 and y is about 3; and

wherein the thermoelectric couples are formed on a single substrate and the flexible substrate is in a coil configuration or an accordion configuration.

2. (Withdrawn) A thermoelectric power source comprising:

a flexible substrate having an upper surface; and

a plurality of thermoelectric couples with the thermoelectric couples comprising:

(a) a sputter deposited thin film p-type thermoelement positioned on the upper surface of the flexible substrate;

(b) a sputter deposited thin film n-type thermoelement positioned on the upper surface of the flexible substrate adjacent the p-type thermoelement;

(c) an electrically conductive member positioned on the flexible substrate, and electrically connecting the first end of the p-type thermoelement with the second end of the n-type thermoelement, wherein the p-type or the n-type thermoelements comprise Bi_xTe_y, Sb_xTe_y, or Bi_xSe_y wherein and x is about 2 and y is about 3;

wherein the thermoelectric couples are formed on a single substrate and the flexible substrate is in a coil configuration or an accordion configuration; and

wherein the p-type or the n-type thermoelements have L/A ratios from about 500 cm^{-1} to about 10,000 cm^{-1}.

3. (Rejected) The thermoelectric power source of claim 1 wherein the p-type and the n-type thermoelements comprise Bi_xTe_y, Sb_xTe_y, and Bi_xSe_y, wherein x is about 2 and y is about 3.

4. (Canceled)

5. (Rejected) The thermoelectric power source of claim 1 wherein the thermoelectric power source has a power output of from 50 μW to 1 W.

6. (Rejected) The thermoelectric power source of claim 1 further comprising at least about 50 thermoelectric couples, wherein the thermoelectric power source has a power output of at least about 1 μW with a voltage of at least about 0.25 volt.

7. (Rejected I) The thermoelectric power source of claim 6 wherein the p-type or the n-type thermoelements are at least about 1 mm in length and at least about 0.1 mm in width.

8. (Rejected) The thermoelectric power source of claim 6 wherein the p-type or the n-type thermoelements are at least about 0.1 mm in thickness.

9. (Rejected) The thermoelectric power source of claim 1 further comprising at least about 1000 thermoelectric couples, wherein the thermoelectric power source has a power output of about 1 W with a voltage of at least about 1 volt.

10. (Rejected) The thermoelectric power source of claim 1 wherein the p-type thermoelements each have a first width, the n-type thermoelements each have a second width, and the first width is different from the second width.

11. (Rejected) The thermoelectric power source of claim 1 wherein two or more p-type thermoelements are positioned and electrically connected in parallel with one another and the parallel positioned p-type thermoelements are electrically connected in series to n-type thermoelements.

12. (Rejected) The thermoelectric power source of claim 1 wherein the thin film p-type thermoelements or the thin film n-type thermoelements comprise Bi_xTe_y and Sb_xTe_y, or Bi_xTe_y and Bi_xSe_y.

13. (Rejected) The thermoelectric power source of claim 1 wherein the volume of the thermoelectric power source is less than about 10 cm^3 and has a power output of from about 1 μW to about 1 W.

14. (Rejected) The thermoelectric power source of claim 1 wherein the volume of the thermoelectric power source is less than about 10 cm^3 and provides voltages of greater than about 1 volt.

15. (Rejected) The thermoelectric power source of claim 14 wherein the thermoelectric power source produces power at temperature differences of about 20°C or less.

16. (Rejected) The thermoelectric power source of claim 1 wherein two or more n-type thermoelements are positioned and electrically connected in parallel with one another and the parallel positioned n-type thermoelements are electrically connected in series to p-type thermoelements.

17. (Rejected) The thermoelectric power source of claim 1 wherein the n-type or the p-type thermoelements-comprise Sb_xTe_y, Bi_xTe_y and Sb_xTe_y, or Sb_xTe_y and Bi_xSe_y.

18. (Rejected) The thermoelectric power source of claim 1 wherein the n-type or the p-type thermoelements comprise Bi_xTe_y and Sb_xTe_y.

19. – 22. (Canceled)

23. (Withdrawn) A thermoelectric power source comprising:

multiple thermocouples electrically connected to one another on an upper surface of a-single flexible substrate, the thermocouples comprising:

sputter deposited thin film p-type thermoelements having thicknesses of 0.1 mm or greater;

sputter deposited thin film n-type thermoelements alternatingly positioned adjacent the p-type thermoelements, the n-type thermoelements having a thickness of about 0.1 mm or greater;

wherein the thermoelectric power source has a volume of less than about 10 cm^3 and has a power output of from about 1 μW to about 1 W generated by the thermocouples on the-single flexible substrate; and

wherein the p-type thermoelements or the n-type thermoelements comprise a Bi_xTe_y, Sb_xTe_y, or Bi_xSe_y alloy where x is about 2 and y is about 3.

24. (Withdrawn) The thermoelectric device of claim 23 wherein said multiple thermocouples electrically connected to one another are in series-parallel.

25. (Withdrawn) The thermoelectric power source of claim 23 wherein the p-type thermoelements have L/A ratios greater than about 500 cm^{-1}.

26. – 36. (Canceled)

37. (Rejected) A thermoelectric power source comprising:

a flexible substrate having an upper surface; and

a thermoelectric couple comprising:

(a) alternating thin film p-type and n-type thermoelements positioned on the upper surface of the flexible substrate;

(b) an electrically conductive member positioned on the flexible substrate, and electrically connecting a first end of the p-type thermoelement with-a second end of the n-type thermoelement, wherein the p-type or the n-type thermoelements comprise Sb_xTe_y or Bi_xSe_y wherein x is about 2 and y is about 3; and

(c) wherein the flexible substrate is in a coil configuration.

38. (Rejected) The thermoelectric power source of claim 37 wherein the p-type thermoelements or the n-type thermoelements are at least about 1 mm in length and at least about 0.1 mm in width.

39. (Rejected) The thermoelectric power source of claim 37 wherein the volume of the thermoelectric power source is less than about 10 cm^3 and has a power output of from about 1 μW to about 1 W.

Evidence Appendix

1. Migowski (PCT Publication No. WO 89/07836) cited in Office Action dated August 4, 2008
2. Migowski (WO 89/07836) English translation filed with Amendment and IDS filed November 29, 2001
3. Böttner ("Thermoelectric Micro Devices: Current State, Recent Developments and Future Aspects for Technological Progress and Applications," Proc. 21st Int. Conf. Thermoelectronics, Long Beach, CA, pp. 511-518 (August 25-29, 2002)) cited in Office action dated April 13, 2009
4. Bass (U.S. Patent No. 6,207,887) cited in Office Action dated August 4, 2008
5. DE '309 (German Patent No. DE 297 23 309) cited in Office Action dated June 27, 2007
6. Stark (U.S. Patent Publication No. 2004/0231714) cited in Office Action dated June 27, 2007
7. Barr (U.S. Patent No. 4,036,665) cited in Office Action dated June 27, 2007
8. Venkatasubramanian (U.S. Patent Publication No. 2003/0099279) cited in Office Action dated June 27, 2007
9. Buist (U.S. Patent No. 4,859,250) cited in Office Action dated August 4, 2008
10. Amendment filed November 27, 2007
11. Amendment after Final Action filed May 20, 2008
12. Amendment filed January 2, 2009
13. Supplemental Amendment filed April 7, 2009
14. Amendment Filed with RCE filed July 13, 2009
15. Amendment filed December 1, 2009
16. Amendment filed September 1, 2010
17. Response after Final Action filed February 7, 2011
18. Inventors § 1.131 Declaration (Fully Executed) filed with Appellant's Amendment filed January 2, 2009
19. Second DeSteese § 1.132 Declaration filed with Appellant's Amendment filed on July 13, 2009
20. McClelland § 1.132 Declaration filed with Appellant's Amendment filed on September 1, 2010

Authorities Cited Appendix

1. *Impax Laboratories Inc. v. Aventis Pharmaceuticals Inc.*, 545 F.3d 1312 (Fed. Cir. 2008).
2. *Minn. Mining & Mfg. Co. v. Chemque, Inc*, 303 F.3d 1294 (Fed. Cir. 2002).
3. *In re Hoeksema*, 399 F.2d 269, 158 USPQ 596 (CCPA 1968).
4. *In re Kubin*, 561 F.3d 1351 (Fed. Cir. 2009).
5. *In re O'Farrell*, 853 F.2d 894 (Fed. Cir. 1988).
6. *KSR Int'l Co. v. Teleflex, Inc.*, 127 S. Ct. 1727 (2007).
7. *In re Wands*, 858 F.2d 731 (Fed. Cir. 1988).

Related Proceedings Appendix

There are no related proceedings.